Joint Workshop on Scientific Writing In Field Epidemiology - Lectures 1-5 (2014-02-25)

Bruce G. Weniger, MD, MPH, International Professor, Chiang Mai University

International Field Epidemiology Training Programme, Champasak Grand Hotel, Pakse, P.D.R. Lao, 25 February - 1 March 2014

JOINT WORKSHOP ON SCIENTIFIC WRITING IN FIELD EPIDEMIOLOGY

Lecture 1: Overview & Principles
Tuesday morning - 2014-02-25

Pakse, Champasak Province, P.D.R. Lao
International Field Epidemiology Training Programme
25 February - 1 March 2014

Overview and Principles

Ensure the study design adheres to fundamental principles of the scientific method

- Successful publication determined by how well the experiment/study was designed and performed
- Editorial wizardry cannot turn the frog of a flawed, unscientific study into the prince of an outstanding publication

Overview and Principles - 2

- Before starting the study ...
  - Consult an expert in research design
    - E.g., senior scientist, epidemiologist, etc.
    - Ensure plan follows scientific method principles
      - Proper study design, controls, random selection, blinding, avoiding bias, etc.
  - Consult a statistician
    - Ensure suitable sample sizes for comparisons
    - Too many submissions with only 3-to-5 mice per arm
    - Unacceptable excuse: "too expensive or difficult to use larger numbers"
- Future manuscript will need to explain and justify your research design and statistical models

Use Traditional Structure

Introduction, Methods, Results, and Discussion, except for good cause

- Aids logical flow of ideas
- Easier to follow for readers (and reviewers)
- Special types of articles do not use this structure
  - Reviews of a subject
  - Editorials
  - Meeting report or conference proceeding
  - Case report

Use Traditional Structure - 2

- Authors sometimes misallocate their phrases and sentences to the wrong section
  - Explains background/reasons for study? → **Introduction**
    - *"… little knowledge of this antibiotic in infants …"*
  - Describes what was done? → **Methods**
    - *"… determined mean inhibitory concentrations (MICs) …"*
  - Reports data generated? → **Results**
    - *"… 17 (68%) of 25 subjects had MICs greater than …"*
  - States implications, compares with others? → **Discussion**
    - *"… second study in this age group …" "… much higher MICs than reported by Somsak, et al via intravenous route."*

The Title

Title should be brief but provide results

- Title orients reader to nature of work and results
- Conveys key finding:
  - Poor: "Study of mobile telephone use and brain cancer"
  - Better: "Status of evidence for association between mobile telephone use and brain cancer"
  - Best: "Mobile telephone use does not appear to increase the risk of brain cancer"
    - (Opposite results for mobile phones and car accidents)
- Sometimes, no single result justifies mention
  - *"Epidemiology of Japanese encephalitis in Laos"*

The Title - 2
Aim for increasing specificity of the title

A New Method for Sirolimus
Analysis of Sirolimus by High-Performance Liquid Chromatography-Mass Spectrometry
Rapid Analysis of Whole-Blood Sirolimus by High-Performance Liquid Chromatography-Mass Spectrometry
Statins and Cholesterol
Effect of Statins on Serum Cholesterol
Reduction of Serum Cholesterol with Statin Therapy
Statin Therapy Reduces Serum Cholesterol in Patients with Cardiovascular Disease
Animal Testing for Flu Viruses
Animal Testing for the H1N1 Virus
Testing of Dogs for the H1N1 Virus
Polymerase Chain Reaction Testing of Dogs for the H1N1 Virus

- Middle example: The most informative title provides independent variable (statin therapy), dependent variable (cholesterol), observed effect (reduction), and population studied (CD patients), using just 10 words

Source: Annesley TM. *The title says it all*. Clin Chem 2010;56(3):357-360 (http://www.clinchem.org/cgi/content/full/56/3/357).
Contents: (http://www.aacc.org/publications/clin_chem/ccgsw/Pages/default.aspx)

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The Title - 3
Avoid wasteful words, boastful claims, abbreviations

- No need for the obvious in reporting research
  - "a study of", "investigation of", "development of", "observations on"
- Be cautious of bragging or self-promotion
  - "new", "first", "improved", "novel", "validated", "sensitive"
- Do not abbreviate in Title unless very common and highly standardized
  - OK: "HIV", "AIDS", "DNA" OK
  - But NOT: "HBV" or "HepB", "EIA" or "ELISA", "EPI", "MOPH" or "MPH", "EMRO"/"WPRO"/"PAHO"

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The Introduction
The why *of your study*

- Puts work into context
  - "Sets the scene", as in a play
    - Audience/reader knows what to expect
  - Educates reader in regard to the study
    - Particular field and area of the research
    - Current understanding and relevant issues
      - May cites key publications by others and authors
      - Avoid extensive literature review!
  - Gaps in knowledge the study aimed to fill

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The Introduction - 2
The why *of your study*

- Explains purpose of study
  - Why was study performed?
  - To fill what knowledge gap?
  - To answer what key research question?
  - Be precise
- If possible, justify why it deserves space in print

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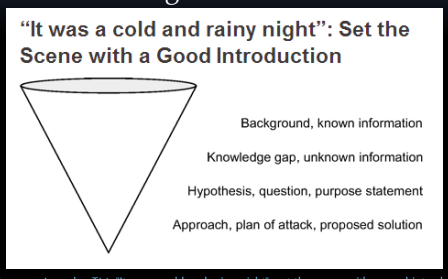
The Introduction - 3
Conical format of perspective

- Horizon changes from broad to narrow



Source: Annesley TM. "It was a cold and rainy night": set the scene with a good introduction. Clin Chem 2010;56(5):708-713 <http://www.clinchem.org/content/56/5/708.full>.

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The Methods
Establishes entire technique of the work

- Provide sufficient details for others to replicate the study
- Good place to cite miscellaneous details
  - Regulatory requirements
    - E.g., identity of ethical oversight committee
  - Publication rules
    - E.g., pre-initiation clinical trial registration number
- In some logical and readable order
  - In parallel to Results, if possible

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The Methods - 2
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- Who?
  - *Who* reviewed/approved the protocol for ethics?
  - *Who* supplied the reagents?
  - *Who* were the subjects recruited?
  - *Who* enrolled the study participants?
  - *Who* collected the specimens?
  - *Who* made the primary diagnosis?
  - *Who* maintained the records?
  - *Who* reviewed the data?
  - *Who* did the statistical analyses?
  - *Who* provided the funding?

Credit this and next 5 slides: Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 13

The Methods - 3
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- What?
  - *What* type of study was it?
  - *What* protocol was followed?
  - *What* were inclusion/exclusion criteria for participants?
  - *What* treatments were given?
  - *What* reagents, lab methods, and instruments were used?
  - *What* validation experiments were performed?
  - *What* endpoints were measured?
  - *What* data transformation was performed?
  - *What* statistical software package was used?
  - *What* was the cutoff for statistical significance?
  - *What* control studies were performed?

Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 14

The Methods - 4
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- When?
  - *When* was the study initiated?
  - *When* was the first patient enrolled?
  - *When* was the last patient treated/examined?
  - *When* were the diagnoses made?
  - *When* were specimens collected?
  - *When* were analyses performed?
  - *When* was the study terminated?

Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 15

The Methods - 5
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- Where?
  - *Where* were the study participants enrolled?
  - *Where* was the study performed?
  - *Where* were the reagents and key equipment manufactured or sourced?
  - *Where* were the specimens analyzed?
  - *Where* were the records kept?

Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 16

The Methods - 6
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- How?
  - *How* was the sample size determined?
  - *How* were patients recruited?
  - *How* were study participants selected?
  - *How* were study participants assigned to groups?
  - *How* were samples collected, processed, stored?
  - *How* many replicates were performed?
  - *How* was response measured?
  - *How* were control and disease groups defined?
  - *How* was the data reported?
  - *How* were endpoints measured?

Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 17

The Methods - 7
Details the Who, What, When, Where, How, *and even some* Why *of the study*

- Why? (related to Methods; others in Introduction)
  - *Why* was a species chosen (mouse, rat)?
  - *Why* was a selected device/analytical method chosen?
  - *Why* was a selected experiment performed?
  - *Why* were experiments done in a certain order?

Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>. 18

The Methods - 8
Examples for biomedical research

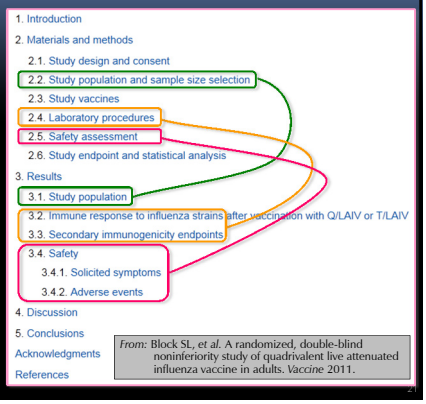
- *What?*
  - Study design
    - E.g., case-control, prospective/retrospective cohort, cross-sectional, case series, etc.
- *How?*
  - Integrity of observation or intervention
    - E.g., blinding, randomization, controls
  - Statistical models used to test and claim "significance"
- *When?*
  - May be relevant for secular trends
    - E.g., influenza seasons, disease pandemics, floods
- *Where?*
  - Institution(s) (hospital, clinic), city, country

The Methods - 9
Describe study steps in a logical order

- NOT by *Who*, *What*, *When*, *Where*, *How*, *Why*
- Alternative options for constructing Methods (and Results)
  - By chronology:
    - Early steps → later steps
  - By importance:
    - most → least important
  - By perspective:
    - General, broad view → specific details
  - By topic or experiment, e.g.:
    - Analysis of reported surveillance data on a disease
    - Population survey for the disease
    - Intervention or experiment on sample of cases
    - Focus group among patients about intervention
    - Questionnaire of patient preferences about intervention
- As parallel as practicable with order used in Results

The Methods - 10

- Use parallel structure
  - Try to follow similar order in both Methods and Results
    - Not always possible



The Methods - 11
Be a good accountant

- Be quantitative in describing your subject sample
  - (Some report such subject numbers in early Results)
- Ensure numbers add up for "dropouts"
- Provide numerators/denominators so readers can do or check percentage calculations

Methods: " ... In recruiting our protocol-designated limit of 450 subjects for the study, we invited 517 to view the explanatory video, of which 482 did so and 461 were willing to have the consent form explained to them. The first 450 of these who volunteered and signed the consent form were thus formally recruited into the study. Of these, 4 (0.9%) subsequently withdrew their consent before any investigational doses were administered, 7 (1.6%) withdrew their consent after one or more doses were received but before followup serum could be collected, 6 (1.3%) failed to return before any post-vaccination serum could be collected and could not be found upon outreach by telephone or letter, and 2 (0.4%) were withdrawn before serum was obtained because of delayed discovery of contraindicating exclusion criterion (seizure disorder) and death (automobile trauma). Thus, sera from a total of 431 subjects were available for assay and analysis. ... "

The Methods - 12
ANALOGY - Methods : Results : Conclusion

- Methods = *"parents"*
  - *It takes parents to make children*
  - *It takes Methods to get Results*
- Results = *"children"*
  - *It takes children to make grandchildren*
  - *It takes Results to justify Conclusions*
- Conclusions = *"grandchildren"*

The Methods - 13
ANALOGY - Methods : Results : Conclusion

- Avoid *"Childless Methods"*
  - No mention in Results of finding or outcome of a procedure described in Methods
    - Remove from Methods, or
    - Add finding(s) from it in Results
      - Example: if Methods says "We surveyed parent preferences for injection method."
        - Then add in Results: "Parents preferred by two to one the jet injector over the needle-and-syringe (data not shown)."
- *Avoid "Orphan Results"*
  - No mention in Methods of finding or outcome in Results
    - Again, remove from Results or add to Methods

The Results
Tables, figures, and associated text reports what *you found*

- ***ORGANIZE AND FINISH TABLES AND FIGURES FIRST !***
  - Before writing a single word of other sections
  - Table and figures are the essence of the work
  - Should provide intuitive understanding
    - To help "see" and comprehend findings
  - Then write Results text to summarize and highlight key points in tables and figures

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The Results - 2
Distinction between "data" and "results"

- Some authorities[1,2,3] distinguish between ...
  - "Data", "raw data"
    - The content of tables and figures
    - Facts and numbers
    - Individual data points
    - Summaries of data (Mean, percent, median, range, etc.)
  - "Results"
    - Statements in Results text summarizing and explaining "data"
    - "Results" gives meaning to the "data"

1. Annesley TM. Clin Chem 2010;56(6):897-901 <http://www.clinchem.org/content/56/6/897.full>.
2. Zeiger M. Essentials of Writing Biomedical Research Papers. 2nd ed. New York: McGraw Hill; 2000 (ISBN 978-0-07-134544-6).
3. Foote M. The proof of the pudding: how to report results and write a good discussion. Chest 2009;135(3):866-868 <http://dx.doi.org/10.1378/chest.08-2613>.

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The Results - 3
Text summarizes and highlights key data in tables and figures

- In Results text, point readers to location for evidence of the finding stated
  - E.g., "... (Figure 1)." "... (see Tables 2 and 3) ..."
- Do not convert all data in tables/figures into words
- Follow similar order as Methods
  - Most important → least important, or
  - Overview perspective → details, or
  - Chronologically, as studied

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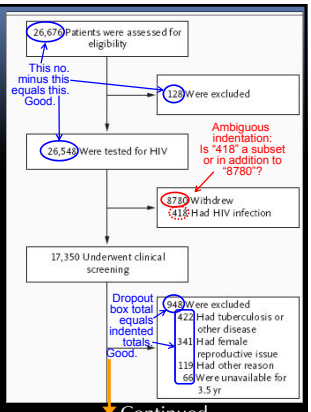
The Results - 4
Accounting

- Keep track of subjects like a bank does your money
  - Where did every *Baht* and *satang* go?
  - Flow chart always in Results
    - Some put its text in Methods
- Flow chart shows how subjects recruited and "dropped out" from analyses
  - Bad arithmetic raises suspicion of flawed work



Color codes of presentation:
"Praise" in blue (or cyan)
"Criticism" in red (or pink)

Rerks-Ngarm, *et al. N Engl J Med.* 2009;361:23:2209-2220

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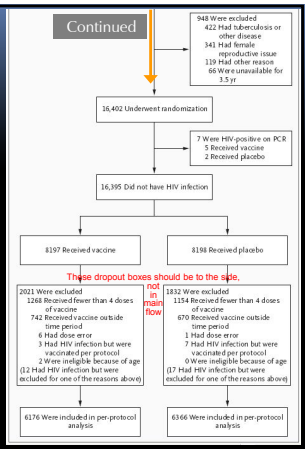
The Results - 5
CONSORT rules

- www.consort-statement.org
- Flow charts required by many major journals for clinical trials
  - Useful for all studies, even if not submitted with manuscript



Rerks-Ngarm, *et al. N Engl J Med.* 2009;361;23:2209-2220

The Results - 6
Probabilities

- Most results are in the form of *probabilities*
  - Cases/events per some *population at risk*
    - Percentage, proportion, rate, ratio, prevalence, incidence
  - Provide numerators and denominators to allow readers to see how % determined

Results: "... Among the 431 subjects from whom post-vaccination sera were available among 450 initially recruited, 141 (32.7%) had been allocated randomly to the investigational **ID-0.1mL** group, 146 (33.9%) to the investigational **IM-0.1mL** group, and the remaining 144 (33.4%) to the **IM-0.5mL** control group. The proportions of these groups which satisfied the criteria of the EMEA for influenza seroconversion [14] were 76% (107/141), 71% (104/146), and 79% (114/144), respectively, which demonstrated *non-inferiority* between both of the low-dose ID and IM groups and their comparator, the full-dose group. ..."

The Discussion

The Discussion section conveys the "so what?" and " who cares?" of the study

- Interpret results, explain significance, draw conclusions
  - May reiterate principal findings
    - But phrase differently from Results
- Relate to original research question(s) and formal hypothesis(es)
- Compare with work by others in this field
  - Partial reprise of Introduction and its citations
  - Corroborates prior work? Contradicts it?

The Discussion - 2

- Point out limitations of study to reviewers, editors, all the world
  - Often hardest aspect of writing a paper
  - Possible things wrong with conception, design, implementation, and analysis
  - Alternative explanations for findings
  - Other research with opposite results
- Reviewers are more comfortable accepting papers so "immunized" from possible error
- To be discussed in more detail in later lecture

The Discussion - 3

- After pointing out weaknesses and limitations …
  - … you earn the privilege to speculate *modestly* on implications of study
    - How it may add to knowledge in the field
    - How it may affect disease prevention, patient care, new diagnostics, technology development, etc.
    - Future followup studies needed
  - *Modest* speculation
    - Means "may …", maybe …", "might …"
    - Not "is …", "will be …"

The Discussion - 4

ANALOGY - Methods : Results : Conclusion

- *Avoid "Orphan Conclusions"*
  - Claims made in Conclusions that lack justifying evidence in Results
    - *a.k.a. "Virgin Births" - no gestation by "parents"* in Results
  - However, authors are permitted some modest *speculation* on the *possible* implications and applications of their work

Exercise 1 – Identify Content Type from Published Abstract

- Allocate abstract sentences into correct categories and in logical order:
  - Introduction
  - Methods
  - Results
  - Discussion

Manuscript-writing Workshop - International Field Epidemiology Training Programme - Pakse, Laos - 2014-02-25 to 2014-03-01

Exercise 1 – Identify Content Type from Published Abstract p. 1 of 1

(Hand out at beginning of Exercise 1)

INSERT ABSTRACT SENTENCES INTO CORRECT SECTIONS OF ABSTRACT, AND IN LOGICAL ORDER

From: Rerks-Ngarm S, et al

Introduction [Background]

Methods

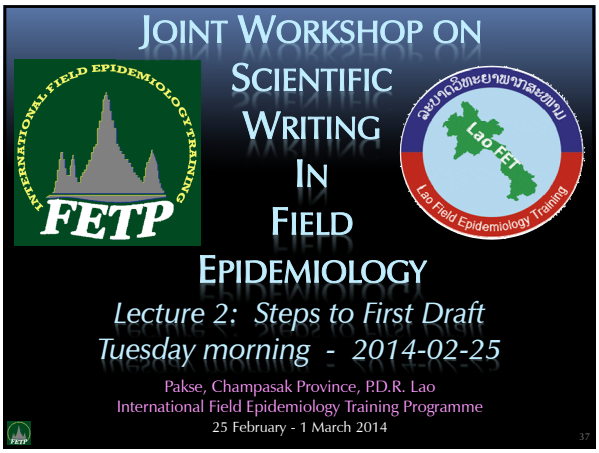
Vaccination did not affect the degree of viremia or the CD4+ T-cell count in subjects in whom HIV-1 infection was subsequently diagnosed. [Supachai A]

In the per-protocol analysis involving 12,542 subjects, the vaccine efficacy was 26.2% (95% CI, −13.3 to 51.9; P=0.16). [Supachai B]

Vaccination did not affect the viral load or CD4+ count in subjects with HIV infection. [Supachai C]

The volunteers, primarily at heterosexual risk for HIV infection, were monitored for the coprimary end points: HIV-1 infection and early HIV-1 viremia, at the end of the 6-month vaccination series and every 6 months thereafter for 3 years. [Supachai D]

End of Exercise 1


JOINT WORKSHOP ON
SCIENTIFIC
WRITING
IN
FIELD
EPIDEMIOLOGY
Lecture 2: Steps to First Draft
Tuesday morning - 2014-02-25
Pakse, Champasak Province, P.D.R. Lao
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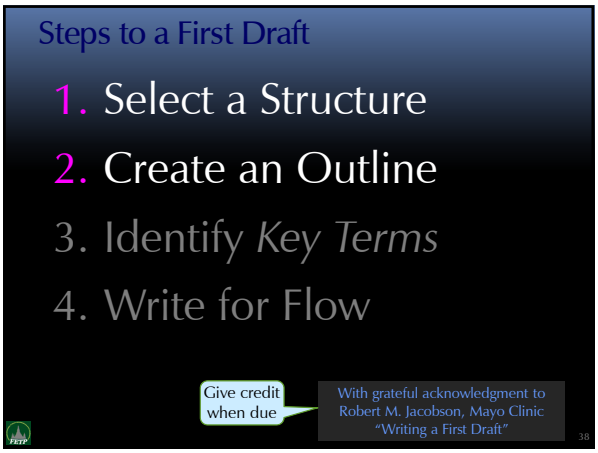
Steps to a First Draft
1. Select a Structure
2. Create an Outline
3. Identify Key Terms
4. Write for Flow
Give credit when due
With grateful acknowledgment to Robert M. Jacobson, Mayo Clinic "Writing a First Draft"
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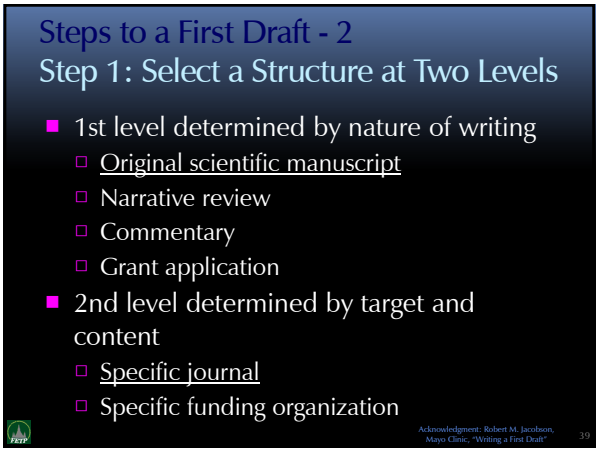
Steps to a First Draft - 2
Step 1: Select a Structure at Two Levels
1st level determined by nature of writing
Original scientific manuscript
Narrative review
Commentary
Grant application
2nd level determined by target and content
Specific journal
Specific funding organization
Acknowledgment: Robert M. Jacobson, Mayo Clinic, "Writing a First Draft"
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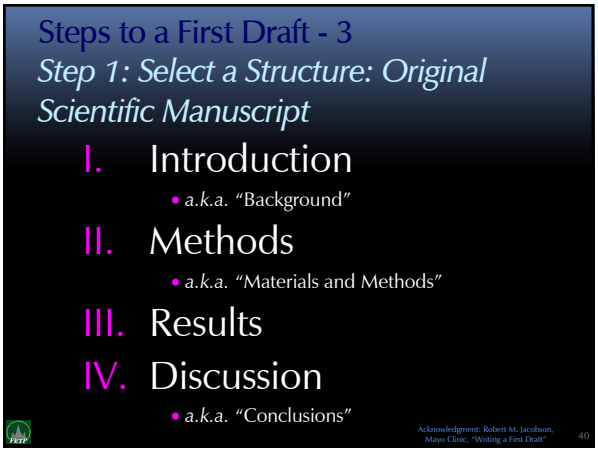
Steps to a First Draft - 3
Step 1: Select a Structure: Original Scientific Manuscript
I. Introduction
a.k.a. "Background"
II. Methods
a.k.a. "Materials and Methods"
III. Results
IV. Discussion
a.k.a. "Conclusions"
Acknowledgment: Robert M. Jacobson, Mayo Clinic, "Writing a First Draft"
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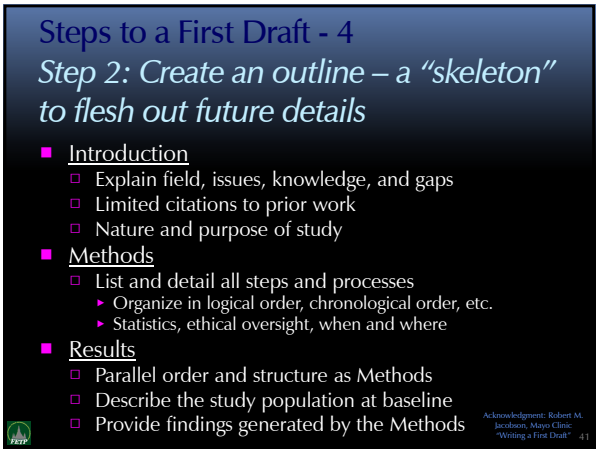
Steps to a First Draft - 4
Step 2: Create an outline – a "skeleton" to flesh out future details
Introduction
Explain field, issues, knowledge, and gaps
Limited citations to prior work
Nature and purpose of study
Methods
List and detail all steps and processes
Organize in logical order, chronological order, etc.
Statistics, ethical oversight, when and where
Results
Parallel order and structure as Methods
Describe the study population at baseline
Provide findings generated by the Methods
Acknowledgment: Robert M. Jacobson, Mayo Clinic "Writing a First Draft"
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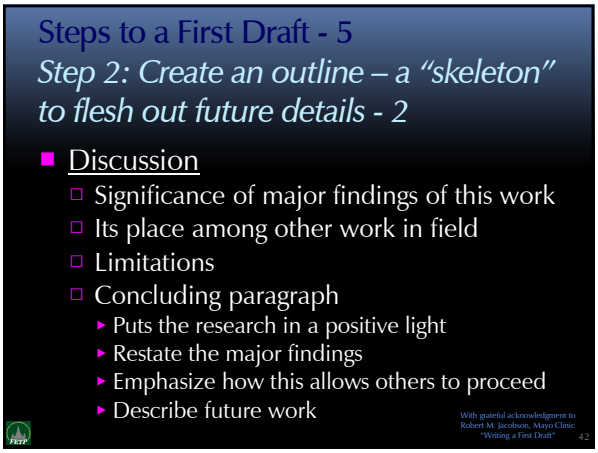
Steps to a First Draft - 5
Step 2: Create an outline – a "skeleton" to flesh out future details - 2
Discussion
Significance of major findings of this work
Its place among other work in field
Limitations
Concluding paragraph
Puts the research in a positive light
Restate the major findings
Emphasize how this allows others to proceed
Describe future work
With grateful acknowledgment to Robert M. Jacobson, Mayo Clinic "Writing a First Draft"
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Steps to a First Draft - 6
Step 2: Create an outline – example

I. Introduction
II. Methods
- A. Recruitment of study participants
- B. Ethical review and regulatory declarations
- C. Questionnaire, survey, specimen collection
- D. Clinical assessment
- E. Laboratory assays
- F. Data management and analysis
- G. Statistical tests

III. Results
- A. Demographic findings
- B. Subjective reports
- C. Prevalence of symptom and signs
- D. Laboratory findings

IV. Discussion

Try to maintain parallel structure, same order, between Methods and Results

With grateful acknowledgment to Robert M. Jacobson, Mayo Clinic "Writing a First Draft"

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Exercise 2 – Create an Outline

- Create 3-level outline of the paper's Introduction, Methods, Results, Discussion
  - First level = I, II, III, IV
  - Second level = A, B, C, D
  - Third level = 1, 2, 3, 4

Decimal style "3.4.2" OK

CREATE at least a 3-LEVEL *OUTLINE* OF Introduction, Methods, Results

I., II., III., IV. = 1st level
A., B., C., D. = 2nd level
1., 2., 3., 4. = 3rd level

Example (just key words/phrases, not sentences)

I. Introduction
- A. Epidemiology
  1. Geography
  2. Agent
  3. _____
  4. _____
  etc.
- B. Clinical Manifestations
  1. _____
  2. _____
  etc.
- C. _____
  1. _____
  2. _____

4-level outline may be provided. For example:

IV. Discussion
- A. Overview
- B. Laboratory
  1. MAT Assay
     a. Past Use
     b. Performance
     c. Technique
     etc.

Suwancharoen D, et al. Serological survey of leptospirosis in livestock in Thailand. Epidemiology & Infection 2013;141:2269-2277.

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Exercise 2 – Create an Outline - 2

- Exercise Discussion
  - Did Introduction educate the reader on current knowledge? What's unknown?
    - Examples?
  - Did Methods "establish" the study?
    - Examples?
  - Did Results deliver on the promise of the Methods?
    - Examples?
  - Did Discussion point to future steps/direction?
    - Examples?

With grateful acknowledgment to Robert M. Jacobson, Mayo Clinic "Writing a First Draft"

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End of Exercise 2

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JOINT WORKSHOP ON SCIENTIFIC WRITING IN FIELD EPIDEMIOLOGY

Lecture 3: Formatting and Writing
Tuesday morning - 2014-02-25

Pakse, Champasak Province, P.D.R. Lao
International Field Epidemiology Training Programme
25 February - 1 March 2014

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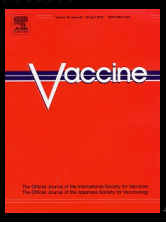
SCIENTIFIC-WRITING WORKSHOP

Lecture 3:

An Editor's Tips on Manuscript Formatting and Writing



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Follow Journal Instructions
Consult carefully the journal's guidelines for authors

- Found at journal's website
  - E.g., http://www.elsevier.com/locate/inca/30521/authorinstructions
  - Or in printed issue of journal
- Provides details on structuring your manuscript
  - Labeling and numbering sections
  - Preparing tables and figures
  - Citing references
- Examine recent articles in journal as examples

Follow Journal Instructions - 2

- Follow guidance for citing reference numbers within text, tables, and figures
  - E.g.: $^{1, 5, 7\text{-}9}$ or [1,5,9] or (1,5,7-9)
    or $^{a, b, c, d}$ (common in tables)
- If journal specifies symbols in certain order as data points in graphs:
  + X □ ■ ● ○ ▲ ▼

  or footnotes in tables:
  * † ‡ § ‖ ¶ ** †† ‡‡ §§ ‖‖

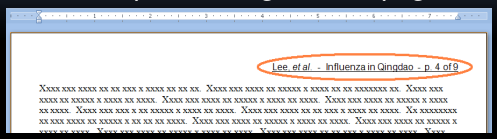
  ... use them

Follow Journal Instructions - 3

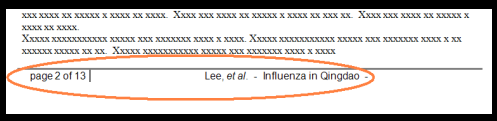
- Following journal style demonstrates authors pay attention to detail
  - Increases credibility for underlying research
    - Authors can follow protocol, too?
- Not following journal style raises doubts about study implementation
  - Authors sloppy? Careless? Deviated from protocol?
  - Borderline manuscripts may be tipped into "reject"

Make the Reviewer's Work Easier

- Headers or footers help find places and assemble printouts; give total pages



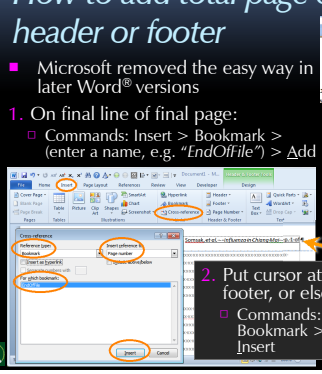
or

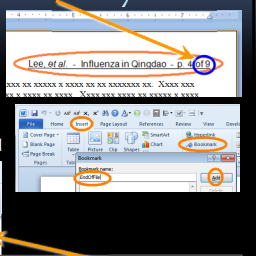


Make the Reviewer's Work Easier - 2
How to add total page count to your header or footer

- Microsoft removed the easy way in later Word® versions

1. On final line of final page:
   - Commands: Insert > Bookmark > (enter a name, e.g. "*EndOfFile*") > Add





2. Put cursor at desired location in header, footer, or elsewhere. Then:
   - Commands: Insert > Cross-reference > Bookmark > Page number > "EndOfFile" > Insert

Make the Reviewer's Work Easier - 3

- Fonts
  - Use a standard font built into Windows®
    - Unless journal specifies another
  - May use different fonts to distinguish header or footer from main text
- Use legible font size
  - Times New Roman:
    - 12 point very legible
    - 11 point minimum
  - Arial
    - 12 point larger than necessary
    - 11 point very legible
    - 10 point minimum
- Line spacing
  - Double-spacing, if suggested by journal
  - 1.5-spacing usually acceptable
  - Leaves room for reviewers to make notes in print copy
- Justification OFF!
  - All lines ***flush left***; right ends of paragraphs "ragged"
  - Justification masks erroneous double spaces between words

Make the Reviewer's Work Easier - 4

- Use continuous line numbering
  - Not restarting as line 1 on each new page
  - In reviews, avoids having to specify page numbers and identify paragraph and sentence
    - For word, phrase, or sentence needing comment
  - In Word®, tab commands: Page Layout > Line Numbers > Continuous

207 reciprocal HI titre for the vaccine virus. The CHMP criteria are fulfilled in subjects
208 aged 18 to 60 years if the point estimate was >40% for SCR, >70% for SPR and >2.5
209 for GMFR. The same CHMP criteria were used for the paediatric studies presented
210 here.
211 The primary safety analysis was based on the total vaccinated cohort (TVC) for
212 each age stratum and overall. The TVC included all vaccinated subjects with at least
213 one vaccine dose documented. The incidence of solicited local and general symptoms

55

Assemble .doc/.docx file properly

- Follow standard order for submissions
  - Unless journal requests otherwise
    1. Title
    2. Authors
    3. Affiliations, corresponding author contact information
    4. Abstract, key words, abbreviations
    5. Introduction, Methods, Results, Discussion
    6. Acknowledgements, conflict disclosures
    7. References
    8. Tables with their numbers and titles
    9. Figure titles and legends
    10. Figures themselves (on separate pages)
        - Add figure numbers outside graph field to identify which is which (titles/legends not on same page)
  - Do not place tables and figures within text!

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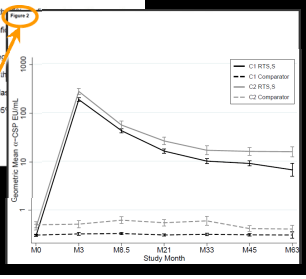
Assemble .doc/.docx file properly - 2

- Figure titles/legends NOT on same page as figures (titles on preceding pages)

423 FIGURE LEGENDS
424 **Fig. 1.** Prevalence of asexual *P. falciparum* parasitemia in Cohort 1 (Manhiça). From study month 8.5 to
425 study month 63, the RTS,S/AS02 group is shown in black lines with
426 the comparator vaccine group is shown in grey lines with 95% confi
427
428 **Fig. 2.** Geometric mean titers of antibodies to the NANP repeat re
429 with pre-vaccination screening (study month 0) through study mo
430 represented by solid lines, and the comparator vaccine group by da
431 shown in black, and Cohort 2 (Ilha Josina) is shown in grey, with 95



- Identify each figure
  - Type in text to identify adjacent figure
  - Well outside figure field

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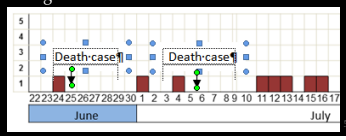
Assemble .doc/.docx file properly - 3

Prepare figures in suitable software

- Use PowerPoint®, Excel®, or other software for making graphs, charts, and their labels
  - Copy and paste entire, finished figure into Word document file at correct page. To revise, return to original software.
- Set Word® commands:
  - File > Options > Display > "Show all formatting marks"
  - After inserting image into Word file, reformat it:
    - Right click > Wrap Text > Top and Bottom
- Use caution adding labels with Word®
  - Creates problems when figures are moved.
  - Create labels in graph software



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Write Well

But don't worry about the English

- Difficult language
  - Many ways to express same idea
  - Very idiomatic, thanks to Shakespeare
    - *"a sea change", "all of a sudden", "mum's the word", "break the ice", "in a pickle", "much ado about nothing"*
  - Spelling does not indicate pronunciation
    - cough="...*off*" rough="...*uff*" bough="...*ow*"
- This editor does not expect good English from non-native-English speaking authors
  - As long as the meaning is expressed, somehow
  - Find a native-English speaker with science background to help edit your English

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Write Well - 3

Merge some sentences for variety

- Poor, boring example (10 sentences):
  1. *"Mount St. Helens erupted on May 18, 1980.*
  2. *A cloud of hot rock and gas surged northward from its collapsing slope.*
  3. *The cloud devastated more than 500 square kilometers of forests and lakes.*
  4. *The effects of Mount St. Helens were well documented with geophysical instruments.*
  5. *The origin of the eruption is not well understood.*
  6. *Volcanic explosions are driven by a rapid expansion of steam.*
  7. *Some scientists believe the steam comes from groundwater heated by the magma.*
  8. *Other scientists believe the steam comes from water originally dissolved in the magma.*
  9. *We need to understand the source of steam in volcanic eruptions.*
  10. *We need to determine how much water the magma contains."*

CREDIT: Michael Alley, Pennsylvania State University

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Write Well - 4
Merge some sentences for variety

- Pleasing, interesting example (5 sentences):
  1. *"Mount St. Helens erupted on May 18, 1980, emitting from its collapsing slope a cloud of hot rock and gas that in minutes devastated more than 500 square kilometers of forests and lakes.*
  2. *Although these effects of the eruption were well documented, its origin is not well understood.*
  3. *Volcanic explosions are driven by a rapid expansion of steam, although its source has recently been debated.*
  4. *Is the steam from groundwater heated by magma, or from water originally dissolved in the magma itself?*
  5. *To understand the source of volcanic steam, we have to determine how much water the magma contains."*

61

Write Well - 5
Define unfamiliar terms

- At first mention, *italicize* and define new terms
- Define directly or indirectly
  - Directly
    - "For purposes of this review, we defined *cutaneous vaccination* as delivery of antigen by all methods anywhere into or onto the skin."
  - Indirectly
    - "Fertility in Thailand started to decline in the late 1960s, reaching as early as the late 1980s the *replacement rate* of 2.1, the average number of births to women of child-bearing age needed to maintain a steady population (Hirschman, *et al*. 1994)."

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Write Well - 6
Use intuitive and consistent abbreviations

- Always define abbreviations, even common ones (exception: common ones in the Title)
  - "Human immunodeficiency virus (HIV)"
  - "Deoxyribonucleic acid" (DNA)"
- Define abbreviations at first use in (1) abstract, (2) text, and (3) in each table/figure footnote
  - Then provide abbreviation only for remainder of uses
  - When definitions extensive, footnotes of first table or first figure can provide them
    - Footnote in later table(s)/figure(s) refers back to prior one for definitions

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Write Well – 7
Use descriptive labels for study groups

- Avoid generic labels
  - "**Group A**", "**Group B**", "**Group C**"
  - Forces forgetful, busy readers back again to Methods
- Use intuitive names that convey group identity
  - "**0.1mL ID**", "**0.1mL IM**", "**0.5mL IM**"
  - "**5-yr Boost**", "**10-yr Boost**", "**15-yr Boost**"
  - "**anti-rAlp3/1:2000**", "**anti-rAlp3/1:10000**", "**anti-rBCPΔIgA/1:2000**"
    - = "recombinant Group B Streptococcus alpha-like protein 3"

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Write Well – 8
Avoid or minimize jargon

- Informal, short-hand, technical terms and abbreviations
- Used in a workplace or narrow field
- Often unknown by many outside the field
- Sometimes have general meaning understood differently by general population
- Examples
  - "Internalizing and externalizing scales"
  - "iPrEx participants"
  - "Neuts"
  - "Open-label"

65

Write Well – 9
Avoid or minimize jargon

- Example with jargon
  - *"For the first year, the links with SDPC and the HAC were not connected, and all required OCS input data that were artificially loaded. Thus CATCH22 and MERWIN were not available."*
- Example without jargon
  - *"Because some of links in the computer system were not connected the first year, we could not run all the software codes."*

CREDIT: Nicole Kelley, Massachusetts Institute of Technology

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Write Well - 10
Avoid needlessly complex language

Category	Example	Substitute
nouns	utilization functionality	use feature
verbs	facilitate finalize	cause end
adjectives	aforementioned individualized	mentioned individual
adverbs	firstly, secondly, heretofore	first, second previous

CREDIT: Nicole Kelley, Massachusetts Institute of Technology

67

Write Well - 11
Remove redundancy

- Three sentences
  - *"Water quality in the Hawk River declined in July. This decline occurred because of the unusually heavy rainfall in July. All the extra rain water overloaded the Tomlin County water treatment plant."*
- One sentence
  - *"Water quality in the Hawk River declined in July because heavy rainfall overloaded the Tomlin County water treatment plant."*

CREDIT: Nicole Kelley, Massachusetts Institute of Technology

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Write Well - 12
Seek both technical review and editing assistance before submission.

- Many submissions are surprising
  - Lack simple editing for grammar, spelling, style
  - Lack technical review by knowledgeable experts
- Share your drafts with colleagues, supervisors, others in same institution and elsewhere
  - Request critical comments and candid feedback
- For non-English speakers, get help editing for good English by a native speaker
  - Ideally someone familiar with science
  - Commercial, internet services available for a fee

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Write Well - 13
Proofread. Proofread. Proofread.

- Simple mistakes ...
  - Arithmetic
    - E.g., numerators and denominators do not add up
  - Formulas
    - E.g., ">" instead of "<" or vice versa
  - Spelling
  - References
    - Wrong order or missing authors, incorrect title, year, issue, pages
- Mistakes raise doubts in reviewers minds
  - Scientific quality of underlying research?
  - Sloppy implementation of study?
  - Flawed analysis?
- Cannot always judge quality from the paper; reviewers use intuition
  - Mistakes may undermine credibility, leading to rejection

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Reviewer Nominations
Suggest potential reviewers who are knowledgeable but do not have real or perceived conflicts of interest

- Many journals welcome nominations
  - Should know the subject matter
- Avoid financial conflicts in nominees
  - Own stock or receive money from manufacturers of products studied in the reported research
- Avoid emotional conflicts in nominees
  - Current or former colleagues at same institution
  - Co-authors of past papers
  - Good friends or relatives

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Submission
Submit the paper to one journal, selected for its scope, mission, and usual content

- Does this journal often publish such reports?
- Does this work fall within the stated subjects of interest for the journal?
- How often do you find similar studies as yours in the journal?
- Review article titles and abstracts over prior year or two
  - Use MEDLINE journal search and journal website

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Submission - 2
Avoid offences in scientific publishing such as plagiarism *and* falsification

- *Plagiarism* = Using another's words and claiming them as ones own
- *Falsification* = Providing fake or fictional data
- *Duplicate submission* = Sending the same work to a second publisher before first has declined it
- *Redundant Publication* = Submitting the same body of work to multiple journals with only minor differences
  - Exception: Non-English papers translated into English when approved in advance by both journals, with clear description of source in second publication
- Offenders subject to banishment from journal(s)
  - No excuses such as "not an issue in my country"
- See *Uniform Requirement for Manuscripts* (http://www.icmje.org)

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Submission - 3
Be patient; proper peer review takes time.

- Many steps required
  - Receiving and processing
  - Assigning editor
  - Identifying subject matter experts to review
    - In addition to those nominated by authors
  - **Vaccine** allows 14 days for reviews; some late needing reminders
- Good experts are busy
- Must sometimes invite 6 – 12 to obtain 2 - 3 willing to accept task

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Manuscript Structure and Principles
Further Reading (and credit to:)

- The Pathway to Publishing: A Guide to Quantitative Scientific Writing
  - http://www.kcri.ac.tz/sites/default/files/uploads/files/Pathway%20to%20Publishing_A%20Guide%20to%20Quantitative%20Scientific%20Writing%20Mar%202012.pdf
- Clinical Chemistry Guide to Scientific Writing
  - http://www.aacc.org/publications/clin_chem/ccgsw/Pages/default.aspx
- Writing Guidelines for Engineering and Science Students
  - http://www.writing.engr.psu.edu
- Technical Communications in Mechanical Engineering
  - http://web.mit.edu/me-ugoffice/communication/
- Uniform Requirement for Manuscripts
  - http://www.icmje.org/

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End of Lecture 3

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JOINT WORKSHOP ON SCIENTIFIC WRITING IN FIELD EPIDEMIOLOGY

Lecture 4: Tables
Tuesday afternoon - 2014-02-25

Pakse, Champasak Province, P.D.R. Lao
International Field Epidemiology Training Programme
25 February - 1 March 2014

77

Tables and Figures
*Key concepts **

- The structure of tables and figures affects how well readers interpret them
  - Example: Scientist measures temperature of a liquid every three minutes, and records them

```
STRUCTURE 1
   t(time)=15', T(temperature °C)=32, t=0', T=25;
   t=6', T=29; t=3', T=27; t=12', T=32; t=9';
   T=31
```

```
STRUCTURE 2
   time(min)  temperature(°C)
        0          25
        3          27
        6          29
        9          31
       12          32
       15          32
```

  - Which structure is easier to interpret? Why?
  - Which side of structure 2 exhibits a pattern of regularity?

* Gopen GD, Swan JA. The science of scientific writing. American Scientist Nov-Dec 1990;78:550-558. http://www-stat.wharton.upenn.edu/~buja/sci.html

78

Tables and Figures
Key concepts - 2

- What happens when the columns of the table are reversed, as in structure 3?

```
STRUCTURE 1
   t(time)=15', T(temperature 'C)=32, t=0', T=25;
   t=6', T=29; t=3', T=27; t=12', T=32; t=9';
   T=31
```

STRUCTURE 2

time(min)	temperature(°C)
0	25
3	27
6	29
9	31
12	32
15	32

STRUCTURE 3

temperature(°C)	time(min)
25	0
27	3
29	6
31	9
32	12
32	15

- Readers prefer context on the left; with new, important information on the right
- Information is interpreted more easily if placed where readers expect to find it
- This applies to both tables and graphs, as well as text (in a later lecture)

79

Tables and Figures
Key concepts - 3

- Tables
  - Use when individual quantitative data and its summaries must be conveyed
  - Use for large amounts of information
- Figures
  - Use to show trends or patterns
  - Use when comparing differences between data sets
  - Use when precision of data not important

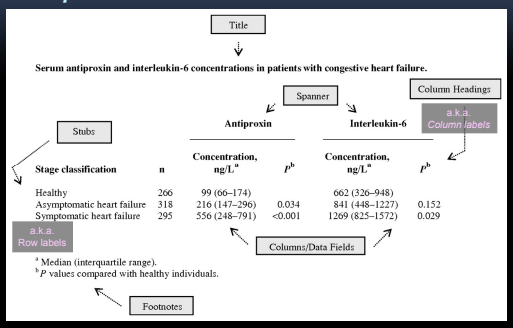
80

Tables and Figures
Titles / legends independent of text

- Titles (a.k.a. "*legends*") should *stand alone*
  - Clear and concise
  - Independent of main text of manuscript
    - Explain content and context enough, without reference to Intro, Methods, or Results sections
- From table or figure, readers should understand
  - Abbreviations: defined in legend, table, footnote
    - Later tables or figures can refer back to where defined
  - Study groups: use intuitive, self-identifying names
  - Data types: identify, e.g., %. $CI_{95\%}$, SEM, SD
  - Source of data: identify if from work of others
- Places where information can be placed
  - Tables: title/legend text, column/row labels, footnotes
  - Figures: title/legend, in-field codes, axis/series labels, footnotes

81

Tables
Components of a table



Source: Annesley TM. *Bring Your Best to the Table*. Clin Chem 2010;56(10):1528-1534 <http://www.clinchem.org/content/56/10/1528.full>.

82

Tables
Components of a table - 2

- Complete title
  - Describe table content in title/legend
- Number precedes the title/legend
  - Table 1. Table 2. Table 3. etc.
- Row labels ("stubs") are usually the independent variables
  - Located in first column on left
  - Use indentation to group subsets within a major grouping
- Columns to the right are dependent variables

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Tables
Components of a table - 3

- Rows and columns labeled clearly, concisely
  - Specific units of measurement shown
    - e.g., "years", "mm Hg", "mg/dL", "per 100,000", etc.
  - Row and column totals always provided
- Use "missing value" columns/
  - Total counted should be consistent with flow chart and other counts in paper

Credit: CDC Principles of Epidemiology, 2nd ed., 1992 (Course 3030-G). http://www.cdc.gov/osels/scientific_edu/SS1978/SS1978.pdf

84

Tables
Show Missing

- Show "missing value" numbers
  - So counts consistent with other parts of paper
  - E.g., Toxin type "unknown"
  - Age, race, sex, etc.
- This table has row totals, but no regional subtotals

Color codes of presentation:
"Praise" in blue (or cyan)
"Criticism" in red (or pink)

Table 2. Reported cases of infant botulism in the world

Area, country	Year	Total	Toxin type A	B	Others	Unknown
Asia, Pacific						
China	1986-1989	2	·	1	·	1
Japan	1986-2007	94	16	3	2	3
Taiwan	1987	1	·	1	·	·
Australia	1978-2006	32	12	15	1	4
Europe						
Czech Republic	1979	1	·	1	·	·
Denmark	1995-2000	2	·	·	1	1
France	1983-2006	2	·	2	·	·
Germany	1993-2000	4	2	·	·	2
Hungary	1996-2003	2	·	·	1	1
Italy	1984-2006	26	4	17	5	·
Netherlands	2000-2005	3	1	2	·	·
Norway	1997-1999	4	4	·	·	·
Spain	1985-2003	9	2	2	·	5
Sweden	1985-2006	3	2	1	·	·
Switzerland	1987	1	1	·	·	·
United Kingdom	1978-2001	5	2	2	1	·
Middle East						
Israel	1994-2006	2	·	2	·	·
Kuwait	2005	1	·	·	·	1
Yemen	1989	1	·	1	·	·
North America						
Canada	1979-2006	27	22	5	·	·
United States	1976-2006	2,412	1,079	1,310	28	2
Latin America						
Mexico	2001	1	1	·	·	·
Argentina	1982-2005	366	366	·	·	·
Chile	1984-1996	3	2	·	·	1
Venezuela	2000	1	·	1	·	·

Modified from Koepke, R. *et al.* Global occurrence of infant botulism 1976-2006. The 44th Annual Interagency Botulism Research Coordinating Committee (IBRCC) Meeting, 2007

Source: Infectious Agents Surveillance Report. *Botulism in Japan as of January 2008*. IASR February 2008;29:35-36 <http://idsc.nih.go.jp/iasr/29/336/tpc336.html>

Tables
Missing components

Table 1
Demographic characteristics of infants and young children from Rochester, Cincinnati and Nashville, 2007–2008.

Variables	Cases N	Cases %	Case-cohort design: Comparison group #1 Subcohort N	Subcohort %	Subcohort P-value[a]	Case-control designs: Comparison group #2 Matched AGE controls N	Matched AGE controls %	Matched AGE controls P-value[a]	Comparison group #3 Matched ARI controls N	Matched ARI controls %	Matched ARI controls P-value[a]
Gender											
Female	42	55	358	48	0.24	89	50	0.45	131	45	0.13
Male	34	45	385	52		90	50		157	55	
Insurance[b]											
Public/none	49	64	286	40	<0.0001	137	77	0.09	224	78	0.02
Private	27	36	436	60		42	23		64	22	
Ever breastfed[c]											
No	38	50	221	31	<0.001	75	42	0.17	128	44	0.41
Yes	38	50	490	69		104	58		160	56	
NVSN site											
Rochester	21	28	204	27	–[d]	30	17	0.26	89	31	0.02
Nashville	16	21	153	21		55	31		106	37	
Cincinnati	39	51	386	52		94	53		93	32	
RV5 doses											
0 Doses	66	87	249	34	<0.0001	117	65	0.03	190	66	0.01
One dose	5	7	72	10		28	16		39	14	
Two doses	3	4	93	13		19	11		32	11	
Three doses	2	3	329	44		15	8		27	9	

Abbreviations: ED, emergency department; RV5, pentavalent rotavirus vaccine.
[a] Compared to cases.
[b] 21 from the subcohort missing insurance information.
[c] 32 from the subcohort missing breastfeeding information.
[d] At each site, 1 cluster of 10 subcohort children was selected per case.

What's missing?

Vaccine 2013;31(24):2692–2697

Tables
Missing components

Table 1
Demographic characteristics of infants and young children from Rochester, Cincinnati and Nashville, 2007–2008.

What is the study about? Who are these children?
Are these N's the numerator or denominator?
Cases of what?
What are the circled abbreviations?

Variables	Cases N	Cases %	Case-cohort design: Comparison group #1 Subcohort N	Subcohort %	Subcohort P-value[a]	Case-control designs: Comparison group #2 Matched AGE controls N	Matched AGE controls %	Matched AGE controls P-value[a]	Comparison group #3 Matched ARI controls N	Matched ARI controls %	Matched ARI controls P-value[a]
Gender											
Female	42	55	358	48	0.24	89	50	0.45	131	45	0.13
Male	34	45	385	52		90	50		157	55	
Insurance[b]											
Public/none	49	64	286	40	<0.0001	137	77	0.09	224	78	0.02
Private	27	36	436	60		42	23		64	22	
Ever breastfed[c]											
No	38	50	221	31	<0.001	75	42	0.17	128	44	0.41
Yes	38	50	490	69		104	58		160	56	
NVSN site											
Rochester	21	28	204	27	–[d]	30	17	0.26	89	31	0.02
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RV5 doses											
0 Doses	66	87	249	34	<0.0001	117	65	0.03	190	66	0.01
One dose	5	7	72	10		28	16		39	14	
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Abbreviations: ED, emergency department; RV5, pentavalent rotavirus vaccine.
[a] Compared to cases.
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[c] 32 from the subcohort missing breastfeeding information.
[d] At each site, 1 cluster of 10 subcohort children was selected per case.

Vaccine 2013;31(24):2692–2697

Tables
Provide Rates, Not Just Cases

- Most scientific findings are in the form of probabilities
  - Case counts are often misleading
- Require both numerator and denominator
  - Expressed as percentage (%) or number "per #,### population"
- Calculate by numerators (cases) above denominators (respective *population at risk*)

Cases and Rates

Source: http://www.acha.org/ILI_Project/ILI_Cumulative.cfm

Influenza Like Illness (ILI) **Participating Colleges** **Cumulative: 22-26 August 2009 - 30 April 2010**
American College Health Association

Table 2: Cumulative College ILI Cases & Peak Rates Reported through: Week Ending Apr 30

HHS Surveillance Region	Total Regional Cases	State/Territory		Cumulative Cases Since Inception	Peak Attack Rate To Date (Per 10,000 Served)	Peak Occurrence Week To Date
Region 7	3,284	Iowa	IA	134	200.0	Week Ending Nov 6
		Kansas	KS	57	114.6	Week Ending Nov 6
		Missouri	MO	2,721	48.4	Week Ending Oct 23
		Nebraska	NE	372	42.8	Week Ending Oct 16
Region 8	4,894	Colorado	CO	3,021	25.0	Week Ending Oct 16
		Montana	MT	534	112.7	Week Ending Oct 16
		North Dakota	ND	3	2.1	Week Ending Sep 25
		South Dakota	SD	291	1,026.3	Week Ending Oct 23
		Utah	UT	812	73.7	Week Ending Nov 6
		Wyoming	WY	233	34.0	Week Ending Oct 2
Region 9	5,564	American Samoa	AS	-	-	-
		Arizona	AZ	627	20.5	Week Ending Oct 9
		California	CA	4,557	20.1	Week Ending Nov 6
		Fed. States of Micronesia	FM	-	-	-
		Guam	GU	-	-	-
		Hawaii	HI	-	-	-
		Marshall Islands	MH	-	-	-
		Nevada	NV	380	37.3	Week Ending Sep 18
		Northern Mariana Islands	MP	-	-	-
		Palau	PW	-	-	-
Region 10	4,211	Alaska	AK	175	18.6	Week Ending Sep 11
		Idaho	ID	288	43.7	Week Ending Oct 16
		Oregon	OR	1,037	94.0	Week Ending Oct 16
		Washington	WA	2,711	366.8	Week Ending Sep 4
Outside U.S.	33	Outside the United States	ZZ	33	6.3	Week Ending Nov 6
TOTALS	95,588			95,588		

Tables
Lists tables versus hierarchy tables

- List tables are *descriptive*
  - Provide information without analysis
    - Caveats: when mixing different types of information
      - Column labels may be inapplicable to some cells
      - Only combine data types if labels can be shared
    - Or, add horizontal line and new column labels
  - Use indenting or parentheses in left-hand column to indicate subsets

Tables
Caution for list tables - example

Table 1 Indentation of row labels (stubs) indicates subsets within groups
Probabilities, costs, and utilities used in the model.

Variable	Value	Unit
Hypothetical cohort of 11–12-year-olds	1 million	People
Time horizon	40	Years
Incidence	25-250 (per 100,000)	
Disease outcomes		
Pneumonia (hospitalized)	2	%
Severe illness	60	%
Moderate illness	38	%
Duration of hospital stay	3	Days
Medical costs for pertussis		
Pneumonia (hospitalized)	70,000	JPY
Severe illness	30,000	JPY
Moderate illness	20,000	JPY
Mortality rate (infant)	0.8	%
Duration of cough	100	Days
Coverage		
11–12-year-olds	70	%
>12-year-olds	20	%
Initial vaccine efficacy	85	%
Duration of vaccine efficacy	10	Years

Multiple data types sharing Same column

No footnotes to define abbreviations

"Coverage" row does not fall within the "Disease outcomes" group

Vaccine 2013;31(27):2891-2897

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Tables
Lists tables versus hierarchy tables

- Hierarchical tables are *analytical*, showing effect of variables
  - Hierarchical "spanners" arrange multiple subgroups in the table
  - Example: "Vision Wire" is experimental new guidewire for heart pacemaking. Two "Galeo" groups are current standard guidewires
    - This experiment "controls for" anterior or posterior electrode location

Table 3. Unipolar transcoronary epicardial R-wave (mean ± standard deviation): VisionWire vs. standard floppy guidewire vs. standard floppy guidewire with insulation by an angioplasty balloon.

	R-wave (mV)					
	Anterior Patch Electrode			Posterior Patch Electrode		
Coronary Vessel	VisionWire Patch Anterior	Galeo Floppy Patch Anterior	Galeo Floppy Balloon Patch Anterior	VisionWire Patch Posterior	Galeo Floppy Patch Posterior	Galeo Floppy Balloon Patch Posterior
RCA	9.4 ± 5.0	3.7 ± 1.0*	7.9 ± 3.9**	10.1 ± 4.7	4.7 ± 3.0*	8.3 ± 4.3**
RCX	11.1 ± 5.2	5.5 ± 2.7*	7.4 ± 5.2**	11.3 ± 4.7	4.8 ± 2.1*	8.3 ± 5.0**
LAD	7.9 ± 3.2	3.9 ± 1.9*	7.2 ± 3.1**	9.6 ± 3.5	5.1 ± 2.3*	7.3 ± 2.0**
All vessels	9.5 ± 4.6	4.5 ± 2.2*	7.5 ± 4.1**	10.4 ± 4.3	4.9 ± 2.4*	8.0 ± 3.9**

*$p < 0.05$ vs. *VisionWire and Galeo floppy balloon*; **$p < 0.05$ vs. *VisionWire and Galeo floppy*
RCA = right coronary artery; RCX = right circumflex artery; LAD = left anterior descending artery

Heinroth KM, Unverzagt S, Buerke M, et al. Transcoronary Pacing in a Porcine Model — Impact of Guidewire Insulation. J Invasive Cardiol 2011;23(3):108-114. http://www.invasivecardiology.com/issue/2682?page=1

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Tables
Caution for hierarchical tables

- Lay out conducive to interpretation
  - Keep together results requiring direct comparison
  - Minimize required eye movements of the reader

1.

A(H1N1)		A(H3N2)		B	
ID [a]	IM [b]	ID [a]	IM [b]	ID [a]	IM [b]
result	result	result	result	result	result

2.

ID			IM		
A(H1N1)	A(H3N2)	B	A(H1N1)	A(H3N2)	B
result	result	result	result	result	result

- In tables with three variables, essential to arrange spanners for easiest side-by-side comparisons

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Tables

Give credit when due — Woodcock NP, et al. Nutrition 2001.

TABLE III.

REASONS FOR INADEQUATE NUTRITIONAL INTAKE (RECEIPT OF LESS THAN 80% OF TARGET INTAKE)

	Parenteral nutrition		Enteral nutrition	
	Group 1 (TPN) *n* = 22	Group 3 (TPN) *n* = 1	Group 2 (EN) *n* = 77	Group 4 (rEN) *n* = 20
Failure to tolerate feed	10 (45%)	2 (100%)	26 (35%)	9 (45%)
Fluid overload	9	2		
Hypernatremia	1	0		
Abnormal liver function	0	0		
Failure of feeding method	13 (59%)	0 (0%)		
No available access	4	0		
Confirmed/suspected line sepsis	6	0		
Mechanical problem with delivery system	3	0		
Other reasons	5 (19%)	0 (0%)		
Undergoing surgery	3	0		
Acute renal failure	2	0		
Large nasogastric aspirates			18	8
Vomiting			5	1
Diarrhea			3	0
Aspiration			2	0
Intestinal leak			1	0
Failure of feeding method			48 (65%)	14 (70%)
Tube pulled out/no available access			34	10
Initial build up of feeding rate			29	4
Infected PEG site			3	0
External bleeding from PEG site			1	0
Mechanical problem with delivery system			4	0
Other reasons			3 (2%)	0 (0%)
Undergoing surgery			2	0
GI hemorrhage			1	0

Explain key terms

Indicate *n* for each group

Intuitive group names

DID NOT keep together most important comparisons

Clear grouping of row items (indenting)

Show both number and percent

Define abbreviations

=N, enteral nutrition; GI, gastrointestinal; PEG, percutaneous endoscopic gastrostomy; rEN, randomized EN; TPN, parenteral nutrition; rTPN, randomized TPN.

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Exercise 3 – Create Two-variable Table from Line Listing

Participants work individually.

Create table on a separate sheet according to the instructions and line listing provided.

Exercise adapted from:

CDC. Principles of Epidemiology: An Introduction to Applied Epidemiology and Biostatistics, 2nd ed. Self-study Course 3030-G, 1992 (http://www.cdc.gov/osels/scientific_edu/SS1978/SS1978.pdf or http://www.facmed.unam.mx/deptos/salud/bibliotecav/epi_course.pdf)

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End of Exercise 3

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Joint Workshop on Scientific Writing In Field Epidemiology

Lecture 5: Graphs

Tuesday afternoon - 2014-02-25

Pakse, Champasak Province, P.D.R. Lao
International Field Epidemiology Training Programme
25 February - 1 March 2014

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Graphs - *Principles*

- Appropriateness:
  - Show data visually that is not easily understandable in text or table
    - E.g., patterns, trends, aberrations, similarities, and differences in data.
    - Better remembered by readers and audience
- Efficiency:
  - Convey maximum data using minimal ink
- Independence:
  - Figure and its legend should stand by itself without reference to text
  - Use titles, legends, and footnotes that explain the content

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Graphs - *Fundamentals*

- *Graphs* have two coordinates
  - Horizontal *x-axis* and vertical *y-axis* -- both continuous variables
    - Y axis - usually the **dependent (or *y*) variable**
      - Often a frequency measure, such as number of cases or rate of disease
    - X axis - usually the **independent (or *x*) variable**, which is what is manipulated or observed by the investigator
      - Often represents time
- *Charts* have 1 continuous and 1 nominal variable
  - E.g., number of cases (a continuous variable) by sex (a nominal variable)
- Types of graphs and charts
  - Simple bar and pie charts display distributions of single variable
  - Grouped and stacked bar charts display ≥2 variables
  - Spot maps pinpoint locations cases or events
  - Area maps use shading or coloring to show different disease level

Credit: CDC Principles of Epidemiology, 2nd ed., 1992 (Course 3030-G).
http://www.cdc.gov/oels/scientific_edu/SS1978/SS1978.pdf

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Graphs - *Key Ingredients and Features*

- Complete title
  - Describe graph content in title/legend
  - Number precedes the title/legend
    - Figure 1. Figure 2. Figure 3. etc.
- Axes
  - Labeled clearly and concisely to show name of the variable and its units
    - e.g., years, mm Hg, mg/dL, rate per 100,000, etc.
  - Scale divisions clearly indicated with tick marks
    - Y-axis starts at zero
    - Range of values of Y-axis scale is set by the largest value to be graphed, plus rounding up
      - Example: largest y-value = 763,094, set highest visible y-axis value at 800,000 or even 1,000,000
  - Scale breaks clearly identified

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Graphs - *Key Ingredients and Features*

- Coordinate (grid) lines
  - Optional; only as many as needed to guide eye to help readers estimate quantitative value of data points (bars or lines)
  - Grid lines drawn lighter than axis lines
- Data plots
  - Drawn clearly
  - Distinguish clearly between multiple plots
  - Each series or component labeled
    - On the graph, in a legend, or in a key
- Footnotes provide details
  - Abbreviations, codes, and symbols explained
  - Later figures can refer back to footnotes in earlier figure
  - All exclusions noted
  - If data not original, source is provided

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Graphs - *Key Ingredients and Features*

- Visual Display
  - No unnecessary information included
  - Figure positioned on page for optimal readability
  - Minimize wasted blank (white) space
  - Provide both high and low sampling error bars, if relevant
- Legibility
  - Font sizes and series color keys sufficiently large for reading without magnifying glass
  - Use empty space to enlarge stingy font sizes and series color codes
- Simplicity
  - Avoid excessive colors or 3-dimensions unless they add value

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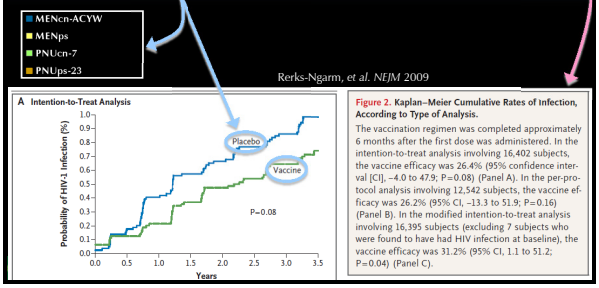
Graphs - *Legends*

- Caveat: two common uses of term "legend"
  - The explanation text that accompanies the figure
  - The key (code) to explain colors or icons in figure



Graphs - *Legends*

- Title legends should:
  - Indicate clearly number of subjects (mice or men) in each study arm (investigational or control)
  - Define nature of high-low sampling error bars
    - 95% C.L., Standard Error (of mean), Standard Deviation
    - In general, avoid SD as it does not reflect sample size

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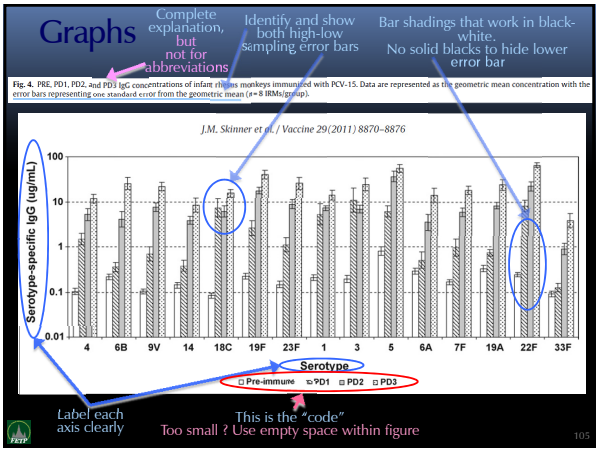
Graphs

Complete explanation, but not for abbreviations

Identify and show both high-low sampling error bars

Bar shadings that work in black-white.
No solid blacks to hide lower error bar



Label each axis clearly

This is the "code"
Too small ? Use empty space within figure

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Graphs - *Dots*

- Dot plots preferable to bar graphs
- Horizontal bars can show
  - Central tendency (e.g., mean)
  - High-low sampling error (not shown here)
- Dots show sample size and skewness
  - Hidden by bar graphs showing only mean
- "Jitter" dots to sides symmetrically to see all data points

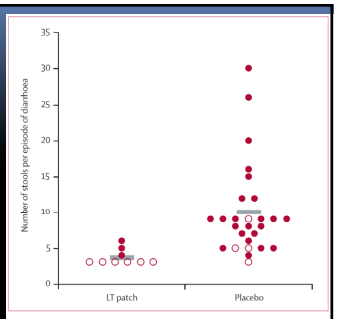

Figure 2: **Severity of diarrhoeal episodes and number of stools by treatment group**
Cumulative stools from individual episodes in LT-patch recipients versus placebo recipients, including analysis population as well as two individuals who had more than one episode (two and three episodes, respectively). Solid spot=moderate to severe episode; White spot=mild episode; Solid bar=mean number of diarrhoea stools per group. Note that placebo-to-vaccine rate

Frech SA, et al. Use of a patch containing heat-labile toxin from Escherichia coli against travellers' diarrhoea: a phase II, randomised, double-blind, placebo-controlled field trial. Lancet 2008;371(9629):2019-2025.

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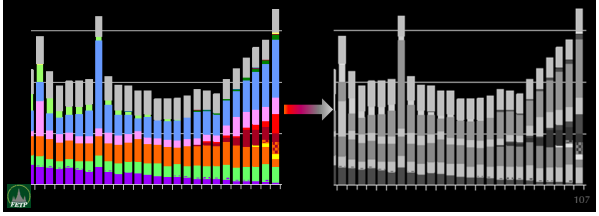
Graphs
Do not rely on color alone

- Data points, lines, and shapes may not be distinguishable in grayscale printouts
- Consider readers without color printers; color blind
- Ensure groups and series are also distinguishable when output from black-white printers



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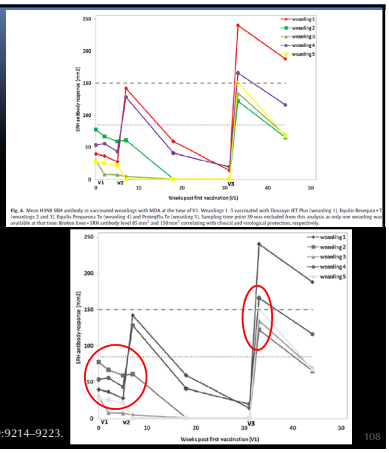
Graphs
Do not rely on color only

- Example
  - Series line distinctions lost in grayscale printout
  - Data point symbols too small to help
- Earlier lesson
  - Be kind to reviewers and readers

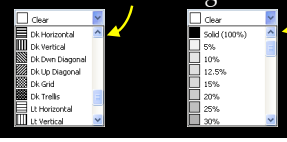


Gildea S, et al. Vaccine 2011;29:9214–9223.

108

Graphs
Do not rely on color alone

- Use more than color for data
  - Data points: use various shapes and symbols
  - Data lines: use dotting patterns
  - Data shapes: use crosshatchings or shadings



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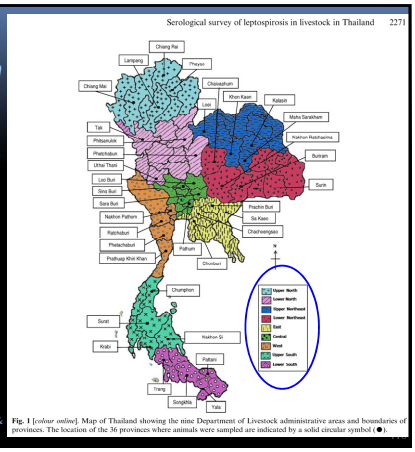
Graphs
Do not rely on color only

- Good example
  - Colors also have different grey-scales
    - (next image)
  - Different pattern fills and symbols distinguish regions
    - + // − Y | ■ □ x △

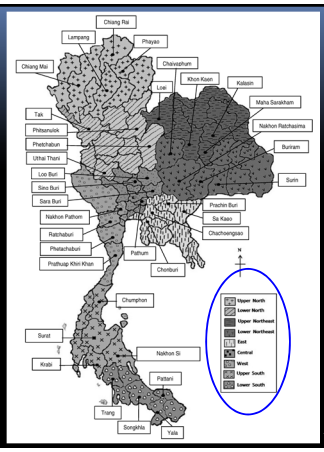


Suwancharoen, *et al.* Epidemiol & Infect 2013;141:2269-77.

Fig. 1 [*colour online*]. Map of Thailand showing the nine Department of Livestock administrative areas and boundaries of provinces. The location of the 36 provinces where animals were sampled are indicated by a solid circular symbol (●).

Graphs
Do not rely on color only

- Good example (cont.)
  - Distinguisable grey-scales
  - Pattern fills and symbols still distinguish regions
    - + // − Y | ■ □ x △



Suwancharoen, *et al.* Epidemiol & Infect 2013;141:2269-77.

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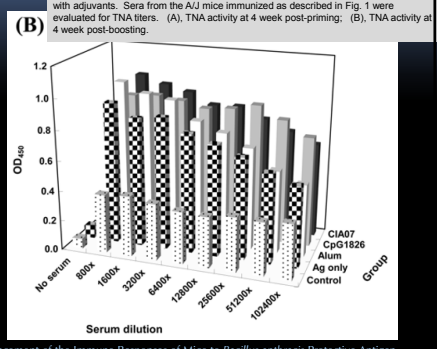
Graphs - *Example to critique*

- Pros?
- Cons?



Kim SH, et al. Enhancement of the Immune Responses of Mice to *Bacillus anthracis* Protective Antigen by CIA07 Combined with Alum. *Arch Pharm Res Vol 31, No 11, 1385-1392, 2008*

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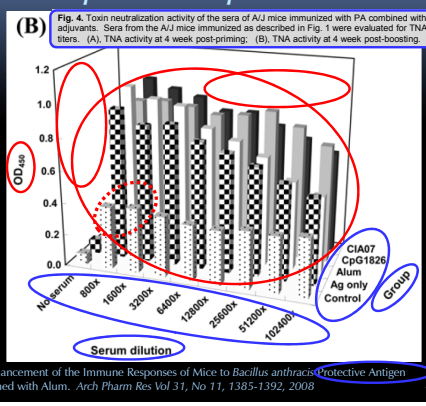
Graphs - *Example to critique*

- Pros?
- Cons?



Kim SH, et al. Enhancement of the Immune Responses of Mice to *Bacillus anthracis* Protective Antigen by CIA07 Combined with Alum. *Arch Pharm Res Vol 31, No 11, 1385-1392, 2008*

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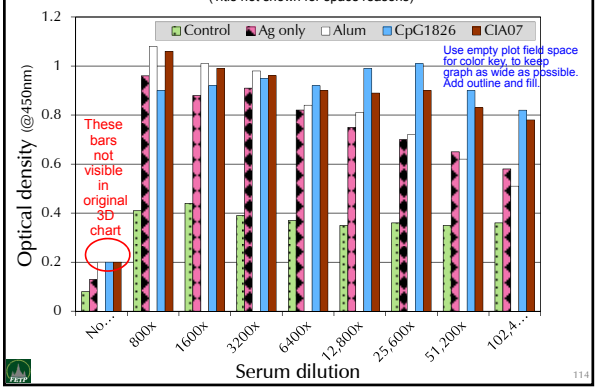
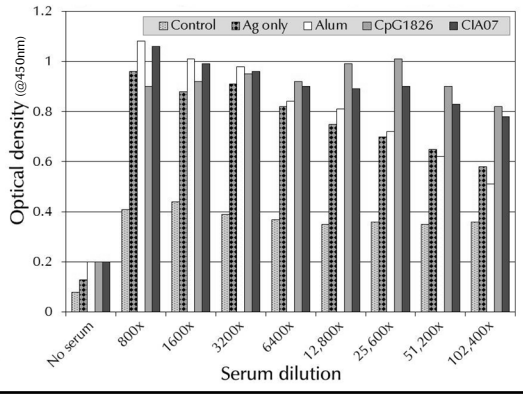
Graphs - *Improved previous example*

(Title not shown for space reasons)



114

Graphs - *Improved previous example*



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Graphs - *Flow Chart Examples*

- Flow charts required only for intervention and cohort trials
  - But useful, even if never published
  - Helps keep track of your subjects
- Top to bottom vertical flow
  - Chronological sequence
- Right or left flow
  - Exclusions and losses to followup

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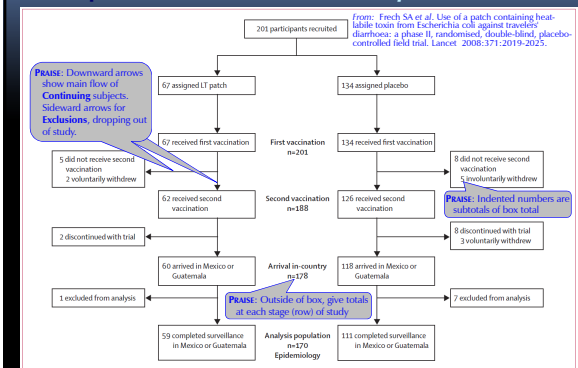
Graphs – *Flow Chart Examples*



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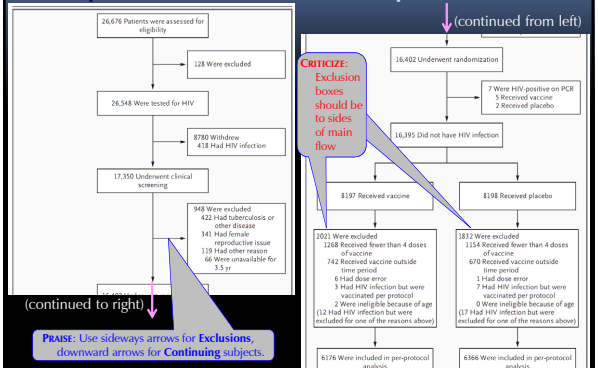
Graphs – *Flow Chart Examples*



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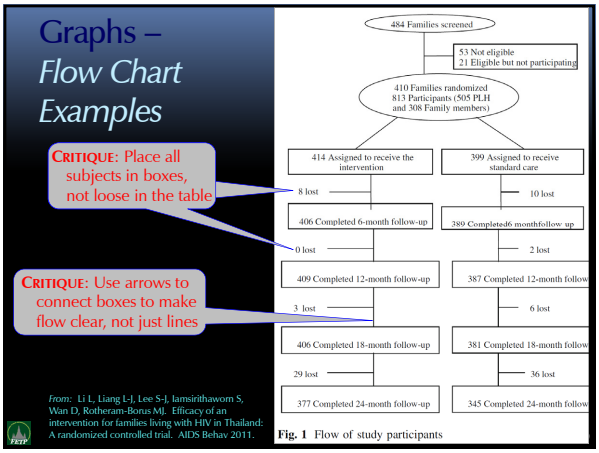
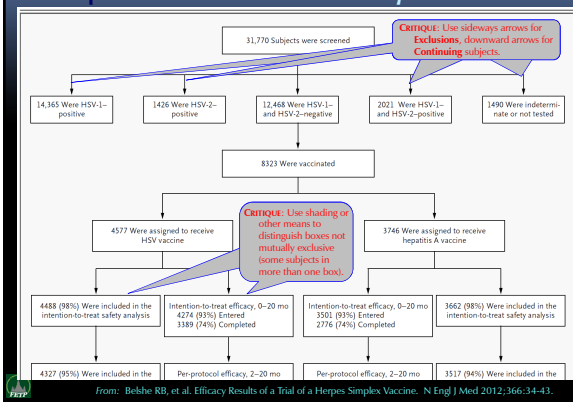
Graphs – *Flow Chart Examples*



Graphs – *Flow Chart Examples*



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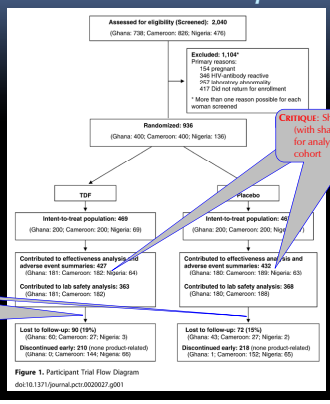
Graphs – *Flow Chart Examples*



CRITIQUE: Should use parallel boxes (with shading or dotted outlines) for analytical subcategories in same cohort

CRITIQUE: Should use sideways arrows for losses to followup and discontinuations, not downward arrows.

From:
Peterson L, et al.
Tenofovir disoproxil fumarate for prevention of HIV infection in women: A phase 2, double-blind, randomized, placebo-controlled trial.
PLoS Clin Trials 2007;2(5):e27

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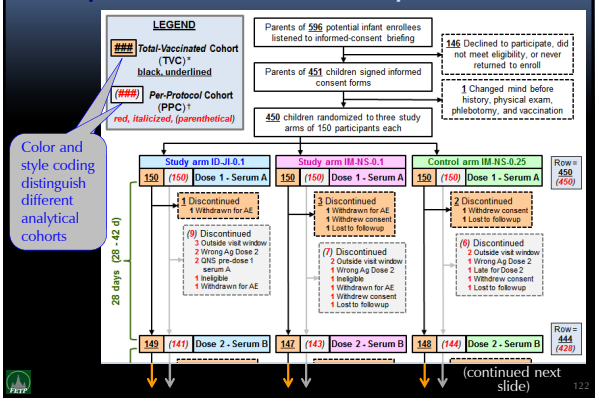
Graphs – *Flow Chart Examples*



Color and style coding distinguish different analytical cohorts

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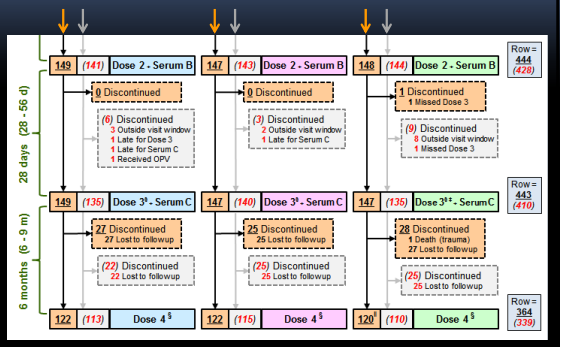
Graphs – *Flow Chart Examples*

(continued from prior slide)



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Exercise 4 – Construct Line Graphs

From: CDC. Principles of Epidemiology: An Introduction to Applied Epidemiology and Biostatistics, 2nd ed. Self-study Course 3030-G, 1992 (http://www.cdc.gov/ovels/scientific_edu/SS1978/SS1978.pdf or http://www.facmed.unam.mx/deptos/salud/bibliotecay/epi_course.pdf).

- GRAPH A *(workshop groups A and C)*:
  - Construct an arithmetic-scale line graph of the case-report data in Table 4.11 below, showing measles rates in the U.S. from 1955-1990.
- GRAPH B *(workshop groups B and D)*:
  - Construct a second arithmetic-scale line graph of the same measles data only for the period from 1980 through 1990.

Be sure to include all the essentials for graphs:
- Complete but succinct title describing subject, person, place, and time, preceded by "Figure" and a number
- Each axis labeled clearly and concisely
- Specific units of measurement included as part of axis labels
- Appropriate scales for each axis for the data represented
- Y-axis starts at zero; clearly identifiable scale break, if any
- Axis lines drawn heavier than other coordinate lines, such as grid lines in the plot field
- Only as many coordinate lines as needed to guide the eye
- Clearly drawn plot(s)
- If data points are shown for multiple series lines, symbols are large enough to distinguish among them
- If multiple series are shown, they are identified clearly by label, legend, and/or key
- Color, shading, and cross-hatching allow each series to be identified on black-and-white printouts
- Footnotes explain all codes, abbreviations, symbols, exclusions, and sources of data
- Efficient use of space with large, legible fonts for all text
- Minimal wasted empty space in plot field

Table 4.11
Measles (rubeola) rate per 100,000 population, United States, 1955-1990

Year	Rate	Year	Rate	Year	Rate
1955	336.3	1967	31.7	1979	6.2
1956	364.1	1968	11.1	1980	6.0
1957	283.4	1969	12.8	1981	1.4
1958	438.2	1970	23.2	1982	0.7
1959	229.3	1971	36.5	1983	0.6
1960	246.3	1972	15.5	1984	1.1
1961	231.6	1973	12.7	1985	1.2
1962	259.0	1974	10.5	1986	2.8
1963	204.2	1975	11.4	1987	1.5
1964	239.4	1976	19.2	1988	1.4
1965	135.1	1977	26.5	1989	7.3
1966	104.2	1978	12.3	1990	10.7

Source: 12

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End of Exercise 4

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